CLAIMS

1. A plasma processing device characterized by comprising:

a table for placing a target object thereon;

a processing vessel for accommodating said table; and

a slot antenna arranged to oppose said table to supply an electromagnetic field into said processing vessel, wherein

radiation coefficients of a plurality of slots formed in an antenna surface of said slot antenna increase monotonously in a radial direction of the antenna surface from a central portion of the antenna surface until a first intermediate portion on the way to a peripheral portion, and maintain values obtained at the first intermediate portion from the first intermediate portion toward the peripheral portion.

2. A plasma processing device according to claim 1, characterized in that lengths of the slots change monotonously from the central portion until the first intermediate portion of the antenna surface, and maintain lengths obtained at the first intermediate portion from the first intermediate portion toward the peripheral portion.

3. A plasma processing device according to claim 2, characterized in that when lengths L of the slots satisfy:

$L \leqq \lambda g/2$

or

$(N/2 + 1/4) \times \lambda g \leqq L \leqq (N + 1) \times \lambda g/2$ (N is a natural number) where λg is a wavelength of an electromagnetic field in said slot antenna, the lengths of the slots increase monotonously from the central portion until the first intermediate portion.

4. A plasma processing device according to claim 2, characterized in that when lengths L of the slots satisfy:

$L \leqq \lambda g/2$

or

$(N/2 + 1/4) \times \lambda g \leqq L \leqq (N + 1) \times \lambda g/2$ (N is a natural number) where λg is a wavelength of an electromagnetic field in said slot antenna, from an innermost slot of the antenna surface until an arbitrary slot of the antenna surface in the radial direction, a length of each slot is larger than that of a slot inside each slot, and from the arbitrary slot toward an outermost slot of the antenna surface, the length of each slot is equal to that of the arbitrary slot.

5. A plasma processing device according to claim

2, characterized in that when the lengths L of the slots satisfy:

$N \times \lambda g/2 \leqq L \leqq (N/2 + 1/4) \times \lambda g$ (N is a natural number) where λg is a wavelength of an electromagnetic field in said slot antenna, the lengths of the slots decrease monotonously from the central portion until the first intermediate portion.

6. A plasma processing device according to claim 2, characterized in that when lengths L of the slots satisfy:

$N \times \lambda g/2 \leqq L \leqq (N/2 + 1/4) \times \lambda g$ (N is a natural number) where λg is a wavelength of an electromagnetic field in said slot antenna, from an innermost slot of the antenna surface until an arbitrary slot of the antenna surface in the radial direction, a length of each slot is smaller than that of a slot inside each slot, and from the arbitrary slot toward an outermost slot of the antenna surface, the length of each slot is equal to that of the arbitrary slot.

7. A plasma processing device according to claim 1, characterized in that, in the radial direction of the antenna surface, the radiation coefficients of the slots maintain values obtained at the first intermediate portion from the first intermediate portion of the antenna surface until the second intermediate portion on

the way to the peripheral portion, and decrease monotonously from the second intermediate portion until the peripheral portion.

8. A plasma processing device according to claim 7, characterized in that lengths of the slots change monotonously from the central portion until the first intermediate portion of the antenna surface, maintain lengths obtained at the first intermediate portion from the first intermediate portion until the second intermediate portion, and change monotonously from the second intermediate portion until the peripheral portion, inversely to the slots from the central portion until the first intermediate portion.

9. A plasma processing device according to claim 8, characterized in that when lengths L of the slots satisfy:

$$L \leqq \lambda g/2$$

or

$$(N/2 + 1/4) \times \lambda g \leqq L \leqq (N + 1) \times \lambda g/2$$ (N is a natural number) where λg is a wavelength of an electromagnetic field in said slot antenna, the lengths of the slots decrease monotonously from the second intermediate portion until the peripheral portion.

10. A plasma processing device according to claim

8, characterized in that when the lengths L of the slots satisfy:

$$L \leqq \lambda g/2$$

or

$(N/2 + 1/4) \times \lambda g \leqq L \leqq (N + 1) \times \lambda g/2$ (N is a natural number) where λg is a wavelength of an electromagnetic field in said slot antenna, from an innermost slot of the antenna surface until a slot at the first intermediate portion of the antenna surface in the radial direction, a length of each slot is larger than that of a slot inside each slot, from the slot at the first intermediate portion until a slot at the second intermediate portion in the radial direction, the length of each slot is equal to that of the slot at the first intermediate portion, and from the slot at the second intermediate portion until an outermost slot in the radial direction, the length of each slot is smaller than that of a slot inside each slot.

11. A plasma processing device according to claim 8, characterized in that when lengths L of the slots satisfy:

$N \times \lambda g/2 \leqq L \leqq (N/2 + 1/4) \times \lambda g$ (N is a natural number) where λg is a wavelength of an electromagnetic field in said slot antenna, the lengths of the slots increase monotonously from the second intermediate portion until the peripheral portion.

12. A plasma processing device according to claim 8, characterized in that when lengths L of the slots satisfy:

$N \times \lambda g/2 \leqq L \leqq (N/2 + 1/4) \times \lambda g$ (N is a natural number) where λg is a wavelength of an electromagnetic field in said slot antenna, from an innermost slot of the antenna surface until a slot at the first intermediate portion of the antenna surface in the radial direction, a length of each slot is smaller than that of a slot inside each slot, from the slot at the first intermediate portion until a slot at the second intermediate portion in the radial direction, the length of each slot is equal to that of the slot at the first intermediate portion, and from the slot at the second intermediate portion until an outermost slot in the radial direction, the length of each slot is larger than that of a slot inside each slot.

13. A plasma generating method characterized in that when an electromagnetic field is supplied into a processing vessel by using a slot antenna in which a plurality of slots are formed in an antenna surface thereof, to generate a plasma, radiation coefficients of the slots are increased monotonously from a central portion of the antenna surface until the first intermediate portion on the way to a peripheral portion,

and values of the radiation coefficients obtained at the first intermediate portion are maintained from the first intermediate portion toward the peripheral portion.

14. A plasma generating method according to claim 13, characterized in that the values of the radiation coefficients obtained at the first intermediate portion are maintained from the first intermediate portion of the antenna surface until a second intermediate portion on the way to the peripheral portion in the radial direction of the antenna surface, and the radiation coefficients are decreased monotonously from the second intermediate portion until the peripheral portion.